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ABSTRACT

Factors in reading comprehension relating to English as a second language (ESL) are considered, focusing on what contributes to text comprehensibility (grammatical structure or density of new vocabulary), the effect of a learner's English language proficiency on use of grammatical words for comprehension, and the possible interaction of these factors with the first language background of the reader. Five hypotheses are proposed, the central one arguing that content words are more essential for comprehension than function words, and the other four investigating the interactive effects of the word-class distinction with the density of unknown words, syntactic complexity, learner English proficiency, and native language background. Results of testing the hypotheses with 33 Spanish-speaking and 16 Arabic-speaking ESL students are reported. It is concluded that knowledge of content words is the most essential knowledge in ESL reading comprehension, and that grammar is secondary, especially if the native language is similar to English. In addition, a density of new vocabulary of about one new word to nine familiar words is suggested as tolerable for ESL learners. A slightly higher dependency on function words is found in low English proficiency students. Implications for the practice of language across the curriculum are discussed. A 52-item reference list is appended. (MSE)

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Vocabulary and other considerations in reading comprehension: implications across the curriculum

by

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ABSTRACT

No one will question that for a student to succeed in his academic work, he has to be able to read well. But there has been much controversy about what is most helpful to the reader. Some scholars have argued that vocabulary knowledge is most predictive of comprehension while others have proposed that a good control of grammar is more essential. In the case of the English as a Second Language (ESL) learner, other considerations are the English proficiency of the learner and the influence of his first language.

A study was conducted on ESL learners. Subjects read several reading texts controlled for unknown word density and syntactic complexity. Their comprehension was tested by two measures: an objective multiple-choice test and a subjective rating of each text.

The results showed that the knowledge of content words is most vital for reading comprehension. The implications for language across the curriculum are obvious. For a learner to read well in any subject, he has to learn the content vocabulary for that subject. Other considerations are secondary.

I. INTRODUCTION

No one will doubt that for a student to succeed in his academic work, he has to be able to read well. And in countries in which English is the medium of instruction, the importance of the ability to read English fluently is obvious. In the Southeast Asian context, English is often not the first language learnt at home. Even if it is, it may not be the variety that is used in school texts. The student is therefore faced with the task of learning to read English as a Second Language (ESL) or a second dialect.

To teachers of ESL reading, a most relevant question is what is most helpful to the learner. What makes a text easier to comprehend? In other words, what constitutes greater difficulty for a reader - the grammatical structure or the density of new vocabulary? Does a learner's English language proficiency affect his use of grammatical words for comprehension? And do these factors interact with the first language background of the reader? These are the questions to consider if one wants to arrive at a better understanding of ESL reading and thus better teaching methodology in ESL reading.

This paper aims at answering the above questions. Most central of all in the study is whether a knowledge of content words helps a reader to understand a text better than a knowledge of function words. The relevance of this issue for language across the curriculum is evident. If content words are more essential for comprehension, then for a learner to read well in any subject, he has to acquire the content vocabulary for that subject.

II. REVIEW OF LITERATURE

There are developments in various fields that are relevant to the issue of text comprehensibility. Among them are language processing, reading theory, reading research and pedagogical practice. Of special interest is the research on the distinction between content words and function words.

Central to language processing is the construction process which is how a listener or reader constructs an interpretation of a sentence from the words he hears or reads. 'They seem to begin by identifying surface structure and end up with an interpretation that resembles an underlying /propositional/ representation' (Clark and Clark 1977:45). Clark and Clark (1977) classify the work on the construction process into two approaches: the syntactic approach and the semantic approach.

In the syntactic approach, we are guided by function words - prepositions, wh-words, conjuctions, complementizers, articles, determiners and verb auxiliaries (Kimball 1973:29,32). Kimball (1973:29) hypothesizes that the presence of a function word guides us to construct a new node in our mental representation of the structure of the sentence. Research on this point (e.g., Fodor and Garrett 1967; Bever 1970) however is not entirely conclusive (Clark and Clark 1977:65).

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In the semantic approach, one of the strategies is to use content words to arrive at the propositions and from the propositional meaning, the grammatical structure of the sentence is built (Clark and Clark 1977:73 citing Bever 1970). The semantic approach is appealing because it uses 'the real meat of a sentence - the content words' (Clark and Clark 1977:79), which are 'nouns, verbs, adverbs, adjectives, pronouns, and non-article determiners' (Just et al. 1982:10 citing Brown 1973). Although the role of semantics is being increasingly recognized (Fodor 1971; Schank 1972; Winograd 1972), there is still much debate on how and when it actually works (Forster 1979; Tyler and Marslen-Wilson 1977; Marslen-Wilson and Tyler 1980).

In any case, what emerges from the language processing literature is the close link between content words and semantics and the relation between function words and syntax.

As for the work on models of reading, the approaches are even more varied. (See Weaver and Resnick 1979:10-11 for a summary of the work of some 50 scholars.) Most of the theoretical work on reading is on reading a first language (L_1). Work on second language (L_2) reading is sparse by comparison. Most L_2 scholars have generally adopted Goodman's (1966-7) model. According to Goodman, the reader can use his knowledge about the world or of the syntax to 'guess' or anticipate what he is going to read. The guessing aspect of Goodman's model is appealing if one considers the L_2 learner's lack of mastery over the second language. Although for a fluent reader, 'reading is a lot easier than guessing' and proceeds much faster, in the case of the L_2 learner, 'there is plenty of time to guess ... and perhaps enough payoff for doing so' (Perfetti In Press: Chap 1:20). Rivers (1981:267) suggests in addition that in the L_2 learner's inferential thinking, 'recourse to syntactic analysis may be bypassed'. Thus, while a learner's knowledge of grammar is insufficient, he may depend more on 'guessing', using pragmatics and semantics activated by his understanding of the content words in a text.

Two factors however are not allowed for in Goodman's (1966-7) model, which was originally put forth to describe L_1 reading. They are the effects according to the L_2 proficiency and the L_1 of the learner. Learners at different proficiency levels do not behave the same (Hatch 1974: 59). Thus, what is helpful at one level may not be helpful at another. And learners of English from one language background (e.g. Spanish) may be able to transfer his reading ability in his L_1 more easily than learners of English from another language background (e.g. Arabic).

The range of ideas in L_1 reading theory is reflected in L_1 reading research. Some studies investigated the role played by the syntactic component in reading comprehension (Nurss 1966; Duda 1976; Christie 1980). One problem with these studies is that sometimes the experimental texts (Schmidt 1977) were so contrived that the effects according to the complexity of the syntax could also be the side-effects according to the accompanying unnatural discourse patterns. The research on vocabulary however has been more promising. As early as 1969, Perfetti already demonstrated that the higher the ratio of lexical words to grammatical words in a text, the more difficult the text is to comprehend. This word classification is almost equivalent to that between content words and function words (Greene 1972:160). In more recent times, Beck et al. (1982:520) showed that 'a vocabulary training program can lead to gains in comprehension'. The work on readability formulae has also found that 'the surest single predictor of text difficulty' (Harrison 1980:19) is vocabulary.

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With reference to the same issues, L_2 reading is less defined in its conclusions. There are some studies on the linguistic components (Cowan 1974; Pakenham 1980; Nesgoda 1982) and some on the question of transfer (Hudelson 1981).

As in theory and research, so too in pedagogy, L_1 reading has a far richer heritage (e.g. Singer 1981) than L_2 reading. Among L_2 teacher trainers, it is still believed that ultimately 'reading is learned rather than taught, and that one learns reading by reading' (Paulston and Bruder 1976:159). However, there is a general consensus that the learner can be guided. He can be taught a number of reading strategies. For example, some syntactic patterns can be taught for recognition at the beginner's level so that the ESL learner can use the syntactic clues in his comprehension (Paulston and Bruder 1976:175; Rivers 1981:267). What is interesting about the syntactic patterns suggested (e.g. Paulston and Bruder 1976:178-80) is that they can usually be summarized as a knowledge of function words and subordination, both of which were incorporated into my experimental design. Besides the grammatical component, there is also an upsurge of interest in vocabulary teaching (Wilkins 1972:112; Keller 1975; Denninghaus 1976; Hammer 1979; Bloom and Shuell 1981). Paulston and Bruder (1976:168) state unequivocally that the 'only thing that most interferes with [their] students' reading is poor vocabulary'.

From the teacher's perspective, work on vocabulary beyond the very beginner's stage generally means work on content words. This is because function words are limited in number. Although the distinction is not clear-cut, a difference does exist. While one can understand the word chair without referring to English syntax, one cannot explain what that means except in relation to its role in a sentence. There is also research evidence that this distinction is relevant in L_1 and L_2 acquisition (Wanner and Gleitman 1982:17; Shapira 1978:254) and L_1 processing (Maclay and Osgood 1959; Bradley 1978; Hatch, Polin and Part 1970; Drewnowski and Healy 1977; Drewnowski 1981; Just et al. 1982:10). Of special interest to this study is a recent experiment on Dutch learners learning to read French (Ulijn 1980). It was found that readers comprehended much worse when they did not know the content words than when they did not know the function words.

In this brief review of approaches to comprehension, models of reading, reading research and pedagogy, I have introduced the background relevant to my study. It is clear that to understand reading comprehension, one has to consider the roles played by different linguistic components. Specifically, it is shown that the distinction between content words and function words is a relevant one in L_1 psycholinguistic processing and research in ESL reading on this issue is therefore appropriate.

III. HYPOTHESES

There are five hypotheses in this study. The central hypothesis argues that content words are more essential for comprehension than function words. The other hypotheses investigate the interactive effects of the

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word-class distinction with the density of unknown words, syntactic complexity, the learner's English proficiency and his L_1 background.

Hypothesis I: Whether a text is comprehensible to a reader depends more on his knowledge of the content words in the text than on his knowledge of the function words.

Hypothesis I is based on the idea that content words are used as building blocks of propositions and are thus more important for arriving at the meaning of the text. Of course, it is obvious that function words alone convey little meaning (Wilkins 1972:111). What is in question is - if one is only given 80% of a text, whether one can comprehend better if the 20% omitted at regular intervals consists of function words rather than content words. This hypothesis is motivated by the various emphases on the use of context to arrive at text meaning. I hope to show that a context rich in semantic information activated by a knowledge of content words is more useful than one with all the syntactic clues offered by function words.

Hypothesis II: A text with 1 unknown word in every 8 or more words can be as comprehensible as a text with all words known by the learner.

Granted that Hypothesis I is true, it will be interesting to know the inferential limits of the reader's mind. Teachers have often recommended guessing vocabulary in context as a reading strategy. But if the text contains too many new words, the reader will be frustrated (Rivers 1981:287). The density of 1 unknown word in 9 words has been used with success in some L_1 reading experiments using children as subjects (Perfetti: personal communication). I want to test a slightly higher density to see if there is a more optimal tolerance level.

Hypothesis III: The adverse effects of unknown words on text comprehensibility according to word class are not affected by syntactic complexity.

I am not claiming that syntax has no effects on text comprehensibility, but that it does not affect the relative importance of content words over function words. In other words, though one would expect function words to be more vital as guiding marks in a text written in complex syntax, these interactive effects are negligible compared to the overriding effects according to the word-class distinction.

Hypothesis IV: There are changes in the dependence on function words in comprehension according to a learner's proficiency level. A learner at the intermediate level needs the presence of function words to guide him in his comprehension more than a learner at the advanced level.

In L_1 reading research, there is some evidence that children in different grades reacted to syntax differently (Heil 1976). It is therefore probable that L_2 learners at different levels of proficiency will use syntactic information differently. I propose the following changes in a ESL learner. When he is a beginner, he encounters all new words as unknown words. He does not know English syntax so he cannot fully appreciate the meanings of function words. His comprehension of a reading text is therefore based very much on guessing from the information given by content words for which he can more easily find translations in his L_1. At the intermediate stage, he has a better understanding of

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syntax and will therefore appreciate the guidance given by function words more than he did at the beginner's level. But at the advanced level, his knowledge of syntax is so good that he has learnt to anticipate syntactic structures and function words so his strategy is thus one of keying in on the content words for fluent reading. Such are the probable stages, but in this study, beginners are not studied as the experimental tasks required a certain level of English proficiency. Thus Hypothesis IV above makes no claims about them.

Hypothesis V: A learner with an L_1 similar to English will be less dependent on function words in his comprehension than one with an L_1 more different from English.

When two languages are similar in structure, such as Spanish and English, it is easier for the ESL learner to find L_1 equivalents for the English function words. As a result, he can learn to key in on the content word slots more easily. But when two languages are more different, such as Arabic and English, he will have more difficulty acquiring the function words and thus the syntactic frames. Consequently, the effects according to word class will not be as distinct.

IV. METHODOLOGY

Two experiments were conducted. The main experiment involved 33 Spanish-speaking learners. Sixteen Arabic-speaking learners participated in the replication. They were foreign students in an intensive ESL programme preparing themselves for academic studies in an American university.

Subjects read 20 reading passages controlled for density and type of unknown words as well as for syntactic complexity. Sixteen of the passages had words deleted from them. The words deleted were either all content words or all function words and the ratio of deletion were 1 in 5 and 1 in 8. The blanks put in place of the deleted words simulated unknown words. As for syntactic complexity, ten passages were written in simple syntax and the other ten in complex syntax. The operational values were mainly based on the classroom distinction between simple and compound/complex sentences. To minimize the effects according to passage content or discourse styles, only biographies were used. Half of them were on scientists or inventors and the other half on artists, politicians and philosophers. In other words, there was a fair representation of science and arts ideas. (See Appendix , p.16 .)

After reading each passage, subjects first rated the passage on a 5-point scale from 'very easy to understand' to 'very difficult to understand'. Then, they answered five multiple-choice questions on that passage. Glossaries in their native language were supplied to ensure that they understood all content words that were not deleted.

While the variables of type and density of unknown words and syntactic complexity were built into the experimental materials, the variable of language proficiency was measured between subjects. The learner's Michigan Test of English Proficiency score was used and he was then classified as either Intermediate or Advanced.

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Hypotheses I to IV were tested statistically using a 3-way analysis of variance on the means of the multiple-choice scores and the difficulty ratings for each experimental condition. The Scheffé post-hoc analysis for pairwise comparison was also used where appropriate. An α-level of 0.05 was used in all statistical calculations. Hypothesis V was not tested statistically but evaluated on the basis of a comparison of the results from the two experiments. (See Lam 1984:35-52 for details.)

V. RESULTS

The results from both experiments were largely the same with reference to Hypotheses I to IV. But there are some interesting differences that could be attributed to language transfer, as predicted by Hypothesis V.

Hypothesis I was supported by the results of both experiments.

Hypothesis I: Whether a text is comprehensible to a reader depends more on his knowledge of the content words in the text than on his knowledge of the function words.

As predicted, unknown content words did make a text less comprehensible than unknown function words in the same ratio. It is clear therefore that for reading comprehension, knowing content words is more important than knowing function words. The differential effects however become negligible as the density of unknown words approached 1 in 8.

Hypothesis II was partially supported in the Spanish experiment and totally supported in the Arabic experiment.

Hypothesis II: A text with 1 unknown word in every 8 or more words can be as comprehensible as a text with all words known by the learner.

In the Spanish experiment, on the basis of the multiple-choice score measure, a text with 1 unknown function word in 8 words was found to be as comprehensible as a text with all words known by the learner, but unknown content words in the same density made a text significantly less comprehensible than one with no unknown words. And the analysis based on the difficulty rating did not support Hypothesis II; the Spanish-speaking subjects rated texts with 1 unknown word in 8 words significantly less comprehensible than texts with no unknown words. This could be attributable to the visual effect of blanks which were used to simulate unknown words. However, in the Arabic experiment, 1 unknown word (whether content word or function word) did not lower text comprehensibility significantly, whichever measure was used.

Thus, in view of the fact that the Arabic sample was smaller, and consequently a higher numerical value would be needed for a difference in comprehensibility to be statistically significant, I would conclude that the results, as a whole, showed that 1 unknown function word in 8 words does make a text more incomprehensible but the critical ratio of content words that can be tolerated with no decrease in comprehensibility appears to be slightly beyond 1 in 8, possibly 1 in 9.

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Hypothesis III was supported by the results from both experiments.

Hypothesis III: The adverse effects of unknown words on text comprehensibility according to word class are not affected by syntactic complexity.

As claimed by Hypothesis III, there were no interactive effects between syntactic structure and the lexical component in the results. A reader does not need the presence of function words more when the syntax is complex. Nor do unknown content words in texts written in complex syntax result in greater incomprehensibility.

Although in this study, the focus is not on syntactic effects in themselves but only on how syntax interacts with the lexical component, it is still interesting to note the main effects of Syntactic Structure. In the analysis based on the multiple-choice scores, Complex Syntax was not less comprehensible than Simple Syntax. In contrast, according to the difficulty rating, it was. This was the case in both experiments. The likely explanation for this difference is that the two measures may represent two stages of processing. The difficulty rating measures the initial effort expended in comprehension while the multiple-choice score measures how well a reader has comprehended. Thus while complex syntax may exact more effort in reading, if the difficulty is surmounted, a learner is not affected by syntax in answering comprehension questions, which tap the propositional representation he has constructed from his reading.

Hypothesis IV was in general not supported by the results of either experiment.

Hypothesis IV: There are changes in the dependence on function words in comprehension according to a learner's proficiency level. A learner at the intermediate level needs the presence of function words to guide him in his comprehension more than a learner at the advanced level.

Hypothesis IV predicted that there would be interactive effects between proficiency and the unknown function word conditions. There was none that was statistically significant. But some of the cell means for the experimental conditions did show some interactive effects. Thus, changes in the use of function words in comprehension, as a learner becomes more proficient in English, cannot be entirely ruled out.

Finally, a comparison of the results of the two experiments showed some support for Hypothesis V.

Hypothesis V: A learner with an L_1 similar to English will be less dependent on function words in his comprehension than one with an L_1 more different from English.

The rank ordering of the means for the lexical conditions (Table 1, p. 8) suggests that the Arabic learners seem to be more affected by unknown word density than the word-class distinction. Note that for the Spanish learners, the two least comprehensible lexical conditions (1c-5, 1c-8) both involved unknown content words. In contrast, for the Arabic learner, the two least comprehensible lexical conditions (1c-5, 1f-5) were unknown words at the ratio of 1 in 5. In view of the fact that Spanish

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and English are more similar in their structural manifestations of the word-class distinction than Arabic and English are (Lam 1984:25), positive transfer from L_1 on the part of the Spanish learner would be a likely explanation for their greater sensitivity to the word-class distinction in English.

Table 1 Spanish and Arabic - Rank ordering of means for lexical conditions

	Spanish		Arabic	
Most comprehensible	MC score	Diff	MC score	Diff
↑	1f-8 (3.28)	0 (1.86)	1f-8 (2.88)	0 (2.11)
	0 (3.22)	1f-8 (2.27)	0 (2.70)	1f-8 (2.34)
	1f-5 (2.97)	1f-5 (2.53)	1c-8 (2.36)	1c-8 (2.48)
	1c-8 (2.54)	1c-8 (2.58)	1f-5 (2.20)	1f-5 (2.63)
↓ Least comprehensible	1c-5 (2.21)	1c-5 (3.04)	1c-5 (1.77)	1c-5 (3.13)

Note: Means are in parentheses. The multiple-choice scores ranged from 0 to 5 and the difficulty ratings ranged from 1 to 5.

Key:

MC score : multiple-choice score

Diff : difficulty rating

0 : no unknown words

1f-5 : 1 unknown function word in 5 words

1f-8 : 1 unknown function word in 8 words

1c-5 : 1 unknown content word in 5 words

1c-8 : 1 unknown content word in 8 words

The overall conclusion from the study is that the knowledge of content words is by far most essential in ESL reading comprehension. The importance of a knowledge of function words or of syntactic structure, that is, grammar, is secondary, especially if a learner's L_1 is similar to English. While content word knowledge is important, the study has also demonstrated that a learner can tolerate a certain density of new words. This ratio is probably around 1 in 9. There was also some indication that a learner with low English proficiency and with an L_1 dissimilar to English may be slightly more dependent on function words in his comprehension, though for every learner, a command of content vocabulary is most predictive of good comprehension.

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VI. PEDAGOGICAL IMPLICATIONS

The findings are of theoretical as well as pedagogical relevance but, in this paper, only pedagogical implications will be discussed. (See Lam 1984:110-5 for theoretical implications.)

The overriding effect of unknown content words on the comprehensibility of a text suggests that we should concentrate on helping the ESL learner increase his content vocabulary for recognition. However, function words should not be neglected either, if we want the learners not merely to guess the meaning of a text but to understand it fully. Since the meanings of function words cannot be appreciated apart from a knowledge of English syntax, some grammatical patterns should be taught for recognition. Although the study has shown no support that complex syntax makes a text more difficult for a learner in terms of an objective multiple-choice score, the learner does feel subjectively that a text written in complex syntax is harder to comprehend. Thus, there is a place for the teaching of grammar to improve reading comprehension.

However, the study has also demonstrated that there is little evidence that one can infer the meaning of new content words using syntactic clues if their density is too high. Thus, such a strategy should not be over-emphasized. But if the density of new words is only about 1 in 9, inferential thinking is likely to be successful. This should give some indication as to what would constitute too difficult material for a learner.

The findings as a whole seem to suggest the following emphases at different levels of proficiency. Since content words were found to be more essential for comprehension, the early emphasis should be on the acquisition of content vocabulary. When the learner has acquired a good number of content words, he will be in a better position to appreciate the meaning of function words and thus the syntactic frames. At this stage, syntactic patterns can be taught in relation to the function words. Since function words are limited in number, once they are acquired, improving one's reading comprehension basically means increasing one's content vocabulary. Therefore, more work on syntactic patterns at this later stage is just wasteful.

If the learner's L_1 is similar to English, positive lexical transfer for content as well as function words should be encouraged. One can for example explain the similarities between Spanish and English prepositions. There is also a place for bilingual dictionaries and even bilingual glossaries on reading passages at the beginning stages of L_2 reading, provided the learner already understands the concepts in his L_1.

The above are the pedagogical implications for teaching ESL reading in general. What insights for language across the curriculum can we draw from these general implications? The most salient conclusion is that for a learner to read well in any subject, he has to acquire the content vocabulary for that subject. A knowledge of grammar - in terms of syntactic patterns and function words - is not going to help him if he does not know the content words. Though there may be some value in teaching patterns of scientific English, the learner will still be at a loss unless he knows the scientific vocabulary. This applies to the learning of other specialized languages. Does it therefore mean

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that ESL teachers should teach science vocabulary, geography vocabulary and so on at the school level and engineering, legal and other academic terms at the tertiary level? This is a formidable task, if not impossible. There are other less simplistic solutions.

First of all, we must remember that language across the curriculum as related to ESL reading is not a single issue. At different stages of the educational process, it is a slightly different problem and requires a different solution. To begin with, it is useful to consider the issue at two levels - the school (primary and secondary) level and the tertiary level. There are two main differences between these levels. At the tertiary level, there is a sudden demand for specialized vocabulary. Secondly, if the learner requires help in ESL reading, he will most likely be able to read in his L_1; in other words, there is enough knowledge of L_1 to facilitate his learning of the English terms if language transfer is possible. At the school level, especially at the primary level, when he is still learning L_1 and L_2, language transfer may not be as successful basically because he may not even understand the concept for that lexical item in his L_1.

At the primary level in particular, when a child learns a language, he is at the same time learning the concepts for the vocabulary he is exposed to. Thus, the teaching of science vocabulary cannot be separated from the teaching of concepts in science. If the child is expected to read science books in English, it is best that he is taught science in English. If we want him to be able to understand English history books, we will have to teach him history in English. This appears simple enough and is nothing new. In the 1940s, for example, America propagated systematic reading instruction from Grades 1 to 12 in each subject under the slogan of 'Every teacher is a teacher of reading.' (Singer 1981:20).

The problem arises, however, if we want the child not only to be able to read a variety of subjects in English but also to be proficient in his mother tongue. What usually happens is that if a child goes to an English-medium school and studies everything in English, he will be able to cope with academic work in English in the university but his knowledge of his mother tongue will not be as good. A typical example is Hongkong. If the child goes to a reputable English school, he will be proficient in English but though he can read the Chinese newspaper, he will prefer to read an English one. Because he only studies Chinese Language/Literature and Civics/Chinese History in Chinese, it takes more effort and time for him to read the Chinese newspaper. But this did not bother the government or the people of Hongkong. With the imminent return of Hongkong to China in 1997, the pragmatic Hongkong people are becoming more concerned with their Chinese literacy.

In Singapore, the situation is different. There has been a lot of emphasis in recent years on developing proficiency in the mother tongue as well as English. As a result, to increase the language exposure time for the mother tongue in English-medium schools and for English in non-English-medium schools, there have been various changes in the curriculum (Morris and Thompson 1979; Kaur 1983). This is especially so in the lower primary level. Subjects such as Civics and Moral Education are taught in the mother tongue and Science and Mathematics are taught in English. This will certainly make a child more proficient in his mother tongue for certain subjects. This proficiency is likely to be reflected

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in his ability to read these content areas better in his mother tongue. Yet, at the same time, it is to be expected that he will not be able to read these same content areas as well in English, if at all - at least, not when he is in primary school. This is because he does not know the English vocabulary for those subjects even if he may have learnt the English syntax and function words while studying other subjects in English. There is no easy remedy to this situation, if one does not think it is desirable. We cannot expect the English language teacher to try to teach civivs and history vocabulary as well in his English class. If he manages to do so by integrating reading passages on these subjects into his reading class, it will be his achievement but it is unfair to burden him with this responsibility. After all, Mathematics and Science teachers do not have to teach English grammar in their classes. Textbook makers, however, may have more time and energy to look into the possibilities of such integration. And since these subjects are already being taught in the mother tongue, they may want to provide native language glossaries to facilitate the child's understanding of these same concepts in English. It is entirely conceivable for a child to be assigned some English readings on the history of Singapore during his mid-year break for example. It should not be too laborious a task for him,if glossaries are provided and if the content is within what he is receiving in his mother tongue classroom.

At the tertiary level, the ESL teacher is faced with a different problem. Most of his students do not have much time to learn the English which they need urgently to understand their lectures and do their readings and assignments. The pressure on the teacher as well as the student is for quick improvement. With the rise of English for Special Purposes (ESP) (Mackay and Mountford 1978) or English for Science and Technology (EST) (Richards 1976) or English for Academic Purposes (EAP), one may think that there are more efficient ways to faster success. Suggestions have been made that we should construct specialized English vocabularies for each subject or a general-purpose academic vocabulary (Lynn 1976). (See also Tickoo 1976 for a survey of EST materials.) Since many specialized terms cannot be taught apart from the concepts, they are best taught by the teacher in that field. But there are general terms such as 'observation', 'relation', 'generalization' 'analysis', 'inconclusive' and so on which are used in different disciplines. These can be taught by the ESL teacher if materials on them are compiled. A second task that the ESL teacher can do to help increase the learner's recognition vocabulary in his field is to set him an extensive reading assignment. An agricultural student can for example read a book about crop cultivation and write a book review of it. The student can also be encouraged to draw up vocabulary lists for his field or to make bilingual flashcards for words he finds hard to remember. Since learners at this level already have a good command of their L_1, bilingual dictionaries can be useful especially at the beginning and intermediate levels. This will facilitate positive lexical transfer. Publishers may also want to work on specialized bilingual dictionaries for a variety of subject areas at an advanced level. A pocket dictionary on architectural terms will be easier to refer to than a huge general dictionary. This will make reading a passage with many new words less laborious and more enjoyable.

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VII. CONCLUSION

What I have tried to do in this paper is to consider the various factors involved in reading comprehension and to report on the findings of my research on this issue. The implications of these findings for language across the curriculum were then discussed. I must stress that my emphasis on content vocabulary is for reading comprehension alone. I do recognize that there is a place for instruction in grammar or discourse styles, especially when one considers language production skills.

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APPENDIX - SAMPLE OF EXPERIMENTAL MATERIALS

BLAISE PASCAL

Pascal (1623 - 1662) was a mathematician° and scientist°. He was born ____ Clermont-Perrand which is in France. ____ he was a boy, Pascal studied mathematics ____ which he had exceptional° skill°. ____ he was sixteen, he wrote an essay on geometry ____ impressed° even the great mathematician Rene Descartes.

____ 1642 and 1644, Pascal invented° an adding machine° ____ made him famous. Among his ____ contributions° was his work in the theory° ____ probability°. He also did a lot of work ____ physics. Pascal did further° work on ____ principles° of Torricelli who in 1643 discovered° ____ air exerts° pressure°. Pascal showed that ____ one goes higher up a mountain, air pressure decreases°. He also formulated° ____ important° principle known since ____ Pascal's Law which states° that pressure exerted ____ the surface° of a fluid° will ____ carried in all directions° through the fluid.

____ 1646, Pascal was converted° to Christianity° and for ____ defence° of its teachings, he wrote ____ book Provincial Letters. The last years of ____ life were spent on writing another book explaining° ____ truth° of Christianity which is that it is ____ faith° rather than reason° that man can ____ saved° and that without God, there is no meaning° ____ life.

How difficult do you find this passage? Circle the number of your answer here.

1. Very easy to understand
2. Easy to understand
3. Average
4. Difficult to understand
5. Very difficult to understand

Now turn to the next page and answer the multiple-choice questions.

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PASCAL - QUESTIONS. Use your answer sheet.

1. Pascal
   A. was a mathematician and a scientist
   B. was a religious writer
   C. wrote an essay on geometry
   D. A, B and C

2. The author tells us that
   A. Pascal's greatest contribution was his work on probability
   B. Pascal became famous because he invented an adding machine
   C. Pascal studied with Rene Descartes
   D. A, B and C

3. Pascal's Law talks about
   A. pressure in fluids
   B. how air pressure decreases as one goes up a mountain
   C. pressure in gases
   D. A and B

4. Pascal
   A. wrote a book on Pascal's Law
   B. did work in physics
   C. did not believe in Torricelli's theory
   D. B and C

5. Pascal thinks that
   A. there is no meaning in life
   B. man is saved by reason
   C. there is truth in Christianity
   D. A and B

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BLAISE PASCAL - SPANISH GLOSSARY

Christianity	cristianismo
contributions	contribuciones
converted	convertido
decreases	decrece; disminua
defence	defensa
directions	direcciones
exceptional	excepcional
exerts	ejerce
faith	fe
fluid	flúido
further	más amplio
impressed	impresionó
machine	maquina
meaning	sentido
pressure	presión
principles	principios
probability	probabilidad
saved	salvado
reason	razonamiento
skill	talento
states	declara
surface	superficie
truth	la verdad

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